DISTRIBUTING COMPUTER PROGRAMS TO A CUSTOMER'S MULTIPLE CLIENT COMPUTERS THROUGH A HYPERTEXT MARKUP LANGUAGE DOCUMENT DISTRIBUTED TO AND STORED ON THE CUSTOMER'S NETWORK SERVER COMPUTER

Technical Field

5   The present invention relates to a system, method and program for the distribution of computer programs through computer networks and particularly object oriented network systems using Hypertext Markup Language

10   (HTML) documents to a customer's local network of server computers and client computers in a manner that is expeditious and involves very little down time of the local network or its components.

Background of Related Art

15   The past decade has been marked by a technological revolution driven by the convergence of the data processing industry with the consumer electronics industry. The effect has driven technologies which have been known and available but relatively quiescent over

20   the years. Two of these technologies are the Internet-related distribution and object oriented programming systems. Both of these technologies are embodied in the object oriented Java programming system. The computer and communications industries are extensively

25   participating in the development and continual upgrading of the Java system. For details and background with respect to the Java system, reference may be made to a typical text, Just Java, 2nd Edition, Peter van der Linden, Sun Microsystems, 1997. The convergence of the

30   electronic entertainment and consumer industries with data processing greatly accelerated the demand for wide

ranging communications distribution channels and the
World Wide Web (Web) or Internet (the terms are used
interchangeably herein), which had quietly existed for
over a generation as a loose academic and government data
5   distribution facility, reached "critical mass" and
commenced a period of phenomenal expansion that has not,
as yet, abated.

     With the expanded accessibility of tens of thousands
of programmers to each other, not to mention to potential
10   users of such programs via the expanded Internet client
base, an obvious need became apparent: cooperative
programming systems wherein program developers could
coact to continuously expand and enhance existing
programs in a distributed programming environment. Also,
15   users could readily obtain and apply these developed
programs. Object oriented programming, which also had
been virtually languishing for a generation, offered the
solution. With its potentially interchangeable objects
or units within which both data attributes and functions
20   were stored in a predefined uniform framework, as well as
the predefined object interfaces with each other, object
oriented programming systems have found acceptance as the
programming system for the Internet. In all areas of
data processing, communications as well as the electronic
25   entertainment and consumer industries having anything to
do with the Internet, there has been a substantial
movement to Java, the Sun Microsystems originated object
oriented programming system.

     Despite all of these advances, there still remains
30   great resistance in all industries and business fields to
new computer programs and significant program upgrades
that offer much in productivity increases. This
resistance results from past experience that equates to

installing new computer programs or significant program
upgrades in existing systems with large amounts of down
time, during which the customer's business, manufacturing
facility or individual worker functions are inoperative

5   or operate at diminished levels. When a business or
production facility is trying to decide whether to
install a new computer system, the concern about down
time, the possible loss of business, as well as stress on
the workers involved very often outweighs the cost of the

10   installation in influencing the decision. The concern
about business and production delays resulting from
installation has become so significant that small
business customers are reluctant to try to make program
changes on their own.

15   The Web has been providing an extensive carrier for
the distribution of all matter of data content, e.g.
text, images, moving images (video recordings) and
computer programs. However, thus far, it has not
provided much help to the small business customers

20   wishing to install new computer programs or making
significant upgrades in such programs. Often the
installation of computer programs transmitted over the
Web will require even greater computer sophistication
than direct installation of such programs because the

25   customer is then required to have some additional
knowledge of the Web and its protocols.

        As the present invention involves the basic Web
document or page, some background as to the structure of
the Web document is appropriate. The basic Web document

30   is formatted in a markup language, usually HTML. The
Java documentation program, JavaDoc, will produce
standard HTML files for outputs to computer controlled

displays to provide standard natural language displays of
the program documentation.

HTML is used there for all forms of display
documentation including the markup of hypertext and
5   hypermedia documents, usually stored with their
respective documents on a Web server in addition to the
above-described programming distribution. HTML is an
application of SGML (Standard Generalized Markup
Language), an ISO standard for defining the structure and
10 contents of any digital document. It should be
recognized that any of the aspects of the present
invention illustrated with respect to HTML would be
equally applicable to SGML. For further details on Java,
JavaDoc or HTML, reference may be made to the texts <u>Just</u>
15 <u>Java</u> (referenced above) or <u>Java in a Nutshell</u>, 2nd
Edition, David Flanagan, O'Reilly publisher, 1997.

<u>Summary of the Present Invention</u>

The present invention offers a solution to the
problems involved in the installation of new programs and
20 program upgrades into the computers in small business
customer networks through the use of a unique Web page
implementation. In the customer's computer controlled
object oriented programming network system, the present
invention involves the transmission to and the storage in
25 a customer server computer connected to the network of a
plurality of client computers, a HTML document that
includes embedded program applets for selectively
accessing each of the application programs being
distributed, and an embedded installation applet for
30 accessing a program for installing the application
programs being distributed on said client computers.
When a user at one of the client computers wishes to have

one of the application programs installed, the user
requests the document, preferably a Web page, i.e. an
HTML implemented document to be displayed, the user
selects one of the application programs for installation
5   by clicking on a displayed Web page link to select the
application program. In response to such a selection,
there are means for sending and storing the installation
applet to the client computer which selected said
application program. However, the selected application
10   program is sent to this client computer only after said
installation applet is stored in said client computer.

It should be noted that the installation applet,
which in turn will access the installation program, may
have already been sent to the client computer and stored
15   therein at the time that the client computer requested
the Web page.

Likewise, the installation applet may have already
been stored on the client computer in connection with the
installation of a previously selected program. Thus, the
20   installation applet is sent only if an installation
applet has not been previously sent to said client
computer.

Brief Description of the Drawings

The present invention will be better understood and
25   its numerous objects and advantages will become more
apparent to those skilled in the art by reference to the
following drawings, in conjunction with the accompanying
specification, in which:

Fig. 1 is a generalized diagrammatic view of a
30   network, such as a local customer network, of a server
computer connected to a Web portion on which the present
invention may be implemented.

Fig. 2 is a block diagram of a data processing system including a central processing unit and network connections via a communications adapter that is capable of functioning both as a customer server computer and the

5   customer's client computers;

Fig. 3 is an illustrative interactive display showing an illustrative Web page with hyperlinks to the program accessing applet, as well as to the installation applet;

10   Fig. 4 is an illustrative flowchart describing the setting up of the elements of the present invention for storing on a customer server a Web page containing the application program applets to be installed and the installation applets; and

15   Fig. 5 is a flowchart of an illustrative run of the program set up in Fig. 4.

Detailed Description of the Preferred Embodiment

Referring to Fig. 1, there is shown a very generalized diagram of a Web portion on which the present

20   invention may be implemented. In the examples which follow, we will use the Web as the computer controlled object oriented programming network system. Actually, the present invention may be implemented on any appropriate network for handling object oriented program

25   systems. The customer network on which the application programs are to be selectively installed is illustrated by server computer 45 having an appropriate I/O 54 and connected to and serving the set of customers client computers 57, each having a user interactive display

30   interface 56, controlled by a conventional Web browser program 59 and an associated cache 49. Customer server 45 is typically connected to the Web 50 via standard Web

wired connections through Web server 53, which may be
provided by a commercial service provider via connections
61.   Reference may be made to the text, <u>Mastering the
Internet</u>, G. H. Cady et al., published by Sybex Inc.,
5   Alameda, CA, 1996, particularly pp. 136-147, for typical
connections between local display stations to the Web 50
via access server 53 through connection 51.

The HTML Web pages used to transmit the program
access applets and program installation applets,
10   according to the present invention, may originate at Web
page resource sites 60 or 62 and be transmitted over the
Web to customer server 45 on which the Web page or
document is stored until the customer client computers
select the application programs for installation, or the
15   Web documents may be input for storage in server 45
through I/O 54 by any other convenient expedient.   In any
event, the Web documents remain stored on server 45 until
one of the client computers 57 accesses and displays the
interactive Web document as will be subsequently
20   described with respect to Fig. 3.

Before going further into the details of specific
embodiments, it will be helpful to understand from a more
general perspective the various elements and methods that
may be related to the present invention.   Since a major
25   aspect of the present invention is directed to Web
documents, such as Web pages, transmitted over networks,
an understanding of networks and their operating
principles would be helpful.   We will not go into great
detail in describing the networks to which the present
30   invention is applicable.   Reference has also been made to
the applicability of the present invention to a global
network, such as the Internet or Web.   For details on

Internet nodes, objects and links, reference is again made to the text, _Mastering the Internet_.

The Internet or Web is a global network of a heterogeneous mix of computer technologies and operating

5   systems. Objects are linked to other objects in the hierarchy through a variety of network server computers. These network servers are the key to network distribution, such as the distribution of Web pages and related documentation. In this connection, the term

10   "documents" is used to describe data transmitted over the Web or other networks and is intended to include Web pages with displayable text, graphics and other images. This displayable information may be still, in motion or animated, e.g. animated GIF images.

15   Web documents are conventionally implemented in HTML language, which is described in detail in the above-referenced text entitled _Just Java_, particularly at Chapter 7, pp. 249-268, dealing with the handling of Web pages; and also in the aforementioned text _Mastering the_

20   _Internet_, particularly at pp. 637-642, on HTML in the formation of Web pages. The images on the Web pages are implemented in a variety of image or graphic files, such as MPEG, JPEG or GIF files, which are described in the text: _Internet: The Complete Reference, Millenium_

25   _Edition_, Young et al., 1999, Osborne/McGraw-Hill, particularly at pp. 728-730.

In addition, aspects of this invention will involve Web browsers. A general and comprehensive description of browsers may be found in the above-mentioned _Mastering_

30   _the Internet_ text at pp. 291-313. More detailed browser descriptions may be found in the _Internet: The Complete Reference, Millennium Edition_ text mentioned above: Chapter 19, pp. 419-454, on the Netscape Navigator;

Chapter 20, pp. 455-494, on the Microsoft Internet
Explorer; and Chapter 21, pp. 495-512, covering Lynx,
Opera and other browsers.

The present invention is implemented using the Java
5   Programming system, which is an object oriented system
utilizing the Java programming language. The Java system
and language are extensively familiar to those skilled in
the art. The text Just Java, that was described above,
comprehensively details the system and language.
10 Nonetheless, it should be helpful to generally review the
known principles of object oriented programming. It
should be understood by those skilled in the art that
object oriented programming techniques involve the
definition, creation, use and instruction of "objects".
15 These objects are software entities comprising data
elements or attributes and methods that manipulate the
data elements. The data and related methods are treated
by the software as an entity and can be created, used and
deleted as such. The data and functions enable objects
20 to model their real world equivalent entity in terms of
its attributes, which can be presented by the data
elements, and its behavior, which can be represented by
its methods.

Referring to Fig. 2, a typical data processing unit
25 is shown that may function as the client computers used
for receiving the Web pages or function as the customer
server computers 59 (Fig. 1). A central processing unit
(CPU) 10, such as one of the PC microprocessors or
workstations, e.g. eServer pSeries available from
30 International Business Machines Corporation (IBM) or Dell
PC microprocessors, is provided and interconnected to
various other components by system bus 12. An operating
system 41 runs on CPU 10, provides control and is used to

coordinate the function of the various components of the
computer of Fig. 2. Operating system 41 may be one of
the commercially available operating systems such as
IBM's AIX or Microsoft's WindowsMe™ or Windows 2000™, as

5   well as UNIX and other IBM AIX operating systems.
Application programs 40, controlled by the system, are
moved into and out of the main memory Random Access
Memory (RAM) 14. These programs include the object
oriented control programs of the present invention for

10   the distribution of application programs from customer
server computers to the client computers of Fig. 1
through the use of a Web page with embedded program
applets for accessing the application programs and for
installing the application program on requesting client

15   computers. These functions will be described hereinafter
in combination with conventional Web browsers (browsers
49, Fig. 1) at client computers, such as Netscape 4.76™
or Microsoft's Internet Explorer™. A Read Only Memory
(ROM) 16 is connected to CPU 10 via bus 12 and includes

20   the Basic Input/Output System (BIOS) that controls the
basic computer functions. RAM 14, I/O adapter 18 and
communications adapter 34 are also interconnected to
system bus 12. I/O adapter 18 may be a Small Computer
System Interface (SCSI) adapter that communicates with

25   the disk storage device 20. The Web browser cache (cache
49, Fig. 1) may be set up on disk storage 20.
Communications adapter 34 interconnects bus 12 with an
outside network. In the customer server, this could be
the Web. I/O devices are also connected to system bus 12

30   via user interface adapter 22 and display adapter 36.
Keyboard 24 and mouse 26 are all interconnected to bus 12
through user interface adapter 22. It is through such
input devices that the user at the client computers may

interactively relate to the Web page programs for
accessing the application programs and for installing the
application program on requesting client computers
according to the present invention.

5   Display adapter 36 includes a frame buffer 39, which
is a storage device that holds a representation of each
pixel on the display screen 38. Images may be stored in
frame buffer 39 for display on monitor 38 through various
components, such as a digital to analog converter (not
10   shown) and the like. By using the aforementioned I/O
devices, a user is capable of inputting information to
the system through the keyboard 24 or mouse 26 and
receiving output information from the system via display
38.

15   Now, with respect to Fig. 3, we will provide an
illustrative example of how the present invention may be
used to interactively relate to the Web page programs for
accessing the application programs and for installing the
application program on requesting client computers
20   according to the present invention. Fig. 3 shows a
typical Web page or document used by a requesting user at
the interactive display 56 of a client computer 57 to
install application programs stored on customer server
computer 45 (Fig. 1). The Web page shown in Fig. 3
25   carries applets including a program for accessing user
selected application programs from the customer server
computer and for installing such accessed application
programs on the client computer. When the client
accesses the Web page of Fig. 3, the applet program for
30   installing the selected application program is
automatically stored in the cache 49 associated with the
browser 59 of the requesting client 57 (Fig. 1), unless
the program for installing has previously been so stored

in the cache. Then, when the user makes a selection 66
(Fig. 3) from the menu 65 of application programs
available from the customer server computer and presses
the install button 67, the applet program for accessing
5   the selected application program gets the application
from customer server 45 and the installation program
automatically installs the application program on the
client computer. List 64 on the Web page lists the
software systems with which the accessing and
10   installation functions are compatible.

Fig. 4 is a flowchart showing the development of a
process according to the present invention for the
distribution of application programs from customer server
computers to the client computers. In the customer's
15   server that serves a plurality of the customers'
computers, there is provided and stored a Web document
including embedded applets for accessing application
programs and applets for installing applications. These
applets may be separate or combined into a single program
20   applet, step 71. There is provided at each of the client
computers the ability to request and display the Web
page, step 72. This may be done under the control of the
Web browser at the client. The client is enabled to
select an application program from a menu of application
25   programs on the Web page, step 73. When the application
program is selected, step 74, the installation applet of
the Web page must be at the requesting client. As
previously described, this may be provided by storing the
installation program applet on the browser cache when the
30   user at the client requests the Web page. At that point,
the applet may be immediately sent, unless the
installation applet has already been obtained, step 76,
e.g. in connection with a previous installation. In any

event, a routine is set up at the client for setting up the applet so that the requested application program may be automatically installed when received, step 75. There is then provided a routine for sending from the server to

5   the client the requested application program for installation, step 77. As previously mentioned, a Web browser, step 78, may be provided for carrying out the previous steps. It should be noted that the Web page itself may be sent to the customer server from a source

10   over the Web, step 79.

        The running of the process set up in Fig. 4 will now be described with respect to the flowchart of Fig. 5. The applications to be distributed are loaded into and stored in the customer server computer, step 81. The Web

15   page to be provided to a requesting client is also set up in the customer server, step 82. A determination is made as to whether a client computer has requested the stored Web page, step 83. If Yes, a further determination is made as to whether the installation applet has already

20   been loaded into the client browser cache, step 84. If No, the installation applet is stored at the requesting client as described above, step 85. Then, or if the determination in step 84 is Yes, a further determination is made as to whether the user at the client computer has

25   selected an application program, step 86. If No, the selection is awaited. If Yes, then the selected application program is accessed from the customer server by the program access applet, step 87, and the application program is installed on the client computer

30   automatically through the installation program, step 88. At this point, a determination may conveniently be made as to whether the session is over, step 89. If Yes, the session is exited. If No, the session is returned to

step 86 where the selection of another application program is awaited.

One of the preferred implementations of the present invention is in application program 40, i.e. a browser
5   program made up of programming steps or instructions resident in RAM 14, Fig. 1, of a Web receiving station and/or Web server during various Web operations. Until required by the computer system, the program instructions may be stored in another readable medium, e.g. in disk
10   drive 20 or in a removable memory, such as an optical disk for use in a CD ROM computer input or in a floppy disk for use in a floppy disk drive computer input. Further, the program instructions may be stored in the memory of another computer prior to use in the system of
15   the present invention and transmitted over a Local Area Network (LAN) or a Wide Area Network (WAN), such as the Web itself, when required by the user of the present invention.

One skilled in the art should appreciate that the
20   processes controlling the present invention are capable of being distributed in the form of computer readable media of a variety of forms. Although certain preferred embodiments have been shown and described, it will be understood that many changes and modifications may be
25   made therein without departing from the scope and intent of the appended claims.